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CHEMOSTERILANTS SCREENED AGAINST THE BOLL WEEVIL IN DIPPING AND FEEDING TESTS

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CHEMOSTERILANTS SCREENED AGAINST THE BOLL WEEVIL IN DIPPING AND FEEDING TESTS

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Ninety-eight candidate compounds were screened during 1969 in the Boll Weevil Research Laboratory at State College, Miss., against the adult boll weevil (*Anthonomus*

grandis Boheman) to determine their effectiveness as chemosterilants in dipping and feeding tests.

MATERIALS AND METHODS

With the exception of four compounds from a chemical company, all compounds were supplied by the Pesticide Chemicals Research Branch, Entomology Research Division, Beltsville, Md., and the Southern Research Institute, Birmingham, Ala.

A laboratory culture of boll weevils was used in the screening program. The larval and adult diets^{2,3} were prepared daily for use.

In the dipping tests, the newly emerged (0-24 hours) adult weevils were dipped once for 15 seconds in water (H_2O) and for 5 seconds in methanol (MeOH), dimethyl sulfoxide (DMSO), or acetone and allowed to dry. In the feeding tests, the compounds were incorporated into the

hot adult diet, then made into pellets, and given to the weevils for 3 days. Twenty-five weevils of each sex were used in each test. They were placed in containers and mated with equal numbers of untreated weevils. Following treatment all test insects were held at 30° C. and fed regular adult diet pellets, which were changed daily.

Egg and mortality counts were made 7 and 14 days after treatment. Half the eggs collected, usually a sample of 50, were implanted on larval medium and the other half were placed on wet filter paper and observed daily up to 7 days for hatch. The egg hatch and emergence data were calculated by dividing the test percent by the control percent and multiplying by 100; however, the test percent was never shown to be more than 100. The mortality was derived by subtracting the control mortality from the test mortality, but the test percent was never shown to be less than 0.

Three criteria of effectiveness were arbitrarily selected and the compounds were tabulated according to these criteria. Table 1 includes compounds that reduced adult emergence to 33 percent or less (effective), from 33 to 66 percent (intermediate), and from 66 to 100 percent (ineffective).

¹ The authors acknowledge the assistance of Mrs. Marie Osborne, of this Division, who reviewed the chemical names, and O. H. Lindig, of the Boll Weevil Research Laboratory, for supplying weevils and diets for test purposes.

² VANDERZANT, E. S., and DAVICH, T. B. LABORATORY REARING OF THE BOLL WEEVIL. A SATISFACTORY LARVAL DIET AND OVIPOSITION STUDIES. Jour. Econ. Ent. 51: 288-291. 1958.

³ GAST, R. T. MASS PRODUCING ARTIFICIAL DIET PELLETS FOR ADULT BOLL WEEVILS. Jour. Econ. Ent. 58: 1024-1025. 1965.

RESULTS AND DISCUSSION

Twenty-nine compounds tested against males and females in dipping and feeding tests at various concentrations reduced adult emergence to 33 percent or less. Thirteen of these compounds reduced adult emergence or fecundity to 0 when tested on males and females; however, mortality was high (>25 percent) for all except 2-pyridinethiol 1-oxide sodium salt (ENT-22596), tretamine (ENT-25296), and hempa (ENT-50882).

2-Pyridinethiol 1-oxide sodium salt and tretamine in dipping tests at 1 and 1.5 percent, respectively, reduced egg laying of treated females to 0 and mortality was 0 and 22 percent, respectively, after 14 days (table 1). Thus 2-pyridinethiol 1-oxide sodium salt and tretamine were the most effective and least toxic compounds tested on females. Hempa was a moderately effective sterilant on males in dipping tests at concentrations of 5, 10, 25, and 50 percent.⁴ When hempa was fed to males for 3 days at 0.15 and 0.2 percent, adult emergence was reduced to 0 and mortality was 25 and 5 percent, respectively, after 14 days (table 1). Hempa was the only male sterilant tested that reduced adult emergence to 0, and mortality was 25 percent or less after 14 days.

Forty compounds tested on males and females demonstrated intermediate effectiveness (reduced emergence to 33–66 percent). 2-Methyl-*p*-benzoquinone (ENT-14931) and hempa (ENT-50882) when fed to females at concentrations of 1 and 0.15 percent, respectively, reduced emergence to 34 and 39 percent. Mortality was 0 and 15 percent, respectively, after 14 days. (*E*)-*N,N'*-vinylenebis(1-aziridinecarboxamide) (ENT-50987) and 4-(*o*-tolylazo)-*o*-toluidine (ENT-52505) when tested on males at 2 and 1 percent, respectively, reduced adult emergence to 36 and 35 percent with no adult mortality after 14 days. These four compounds, and many others reducing emergence to 0–33 percent warrant further testing.

The least effective compounds, 76 in all, reduced emergence to 66–100 percent. Mortality of treated weevils was low in most of these tests. Although the most effective sterilizing compounds are listed under those reducing emergence to 0–33 percent, they were generally the most toxic to the weevil; however, 2-pyridinethiol 1-oxide sodium salt, tretamine, and hempa were the most effective sterilants in overall dipping and feeding tests where toxicity was low.

SUMMARY

Ninety-eight candidate chemosterilants were tested against the adult boll weevil (*Anththonomus grandis* Boheman) in dipping and feeding tests at various concentrations. 2-Pyridinethiol

1-oxide sodium salt and tretamine in dipping tests at 1 and 1.5 percent reduced egg laying of treated females to 0 and mortality was 0 and 22 percent, respectively, after 14 days. Hempa, when fed to males at 0.15 and 0.2 percent reduced adult emergence to 0 and mortality was 25 and 5 percent, respectively, after 14 days.

⁴ HAYNES, J. W., HEDIN, P. A., and DAVICH, T. B. HEMPA AND APHOLATE AS CHEMOSTERILANTS FOR THE BOLL WEEVIL. *Jour. Econ. Ent.* 59: 1014–1015. 1966.

TABLE 1.—*Relative effectiveness of candidate chemosterilants on boll weevil hatch, adult emergence, and mortality in dipping and feeding tests. (1 replication of 25 pairs of weevils per test)*

Entomology No. (ENT-)	Chemical and concentration (percent)	Solvent	Test and sex treated	Average hatch	Percent	Average adult emergence	Mortality after 14 days	Percent
EMERGENCE REDUCED TO 0-33 PERCENT								
2546	Furil, 2	MeOH	Dip M 1	100	32	0	2	
15229	Anthranilic acid, 5-chloro, 2	MeOH	Dip F	86	20	0	0	
22596	2-Pyridinethiol, 1-oxide, sodium salt:							
1		H ₂ O	Dip F	(2)	0	0	0	
2		MeOH	Dip M	(2)	0	0	38	
2		MeOH	Dip F	(2)	0	0	42	
.5		.....	Fed M	0	0	0	64	
.5		.....	Fed F ³	(2)	0	0	64	
24915	Phosphine oxide, tris(1-aziridiny)-:							
2		H ₂ O	Dip M	0	0	0	46	
2		H ₂ O	Dip F	(2)	0	0	54	
25012	1,4-Butanediol, dimethanesulfonate:							
0.1		.....	Fed M	0	0	0	88	
1		.....	Fed F	(2)	0	0	80	
.25		.....	Fed M	0	0	0	88	
.25		.....	Fed F	(2)	0	0	76	
.5		.....	Fed M	0	0	0	88	
.5		.....	Fed F	(2)	0	0	88	
25296	s-Triazine, 2,4,6-tris(1-aziridiny)- (tretamine):							
1.5		H ₂ O	Dip M	0	0	0	38	
1.5		H ₂ O	Dip F	54	0	0	22	
10		H ₂ O	Dip M	0	0	0	68	
10		H ₂ O	Dip F	0	0	0	80	
26685	Triethylamine, 2"-chloro-1,1'-dimethyl, monohydrochloride, 0.1	.....	Fed F	0	0	0	62	
34254	3,7-Tetradecadien-2-one, 11,12-epoxy-8-ethyl- 4,12-dimethyl-(mixed isomers), 0.7	.....	Fed F	100	33	33	14	

See footnotes at end of table.

TABLE 1.—*Relative effectiveness of candidate chemosterilants on boll weevil hatch, adult emergence, and mortality in dipping and feeding tests. (1 replication of 25 pairs of weevils per test)—Continued*

Entomology No. (ENT-)	Chemical and concentration (percent)	Solvent	Test and sex treated	Average hatch	Average adult emergence	Mortality after 14 days	Percent	Percent	Percent	Percent	Percent
50466	Acetohydroxamic acid, <i>N</i> -fluoren-2-yl-:										
	0.0625.	.....	Fed F	100	0	66					
	.125 .	.....	Fed F	(2)	...	86					
50761	Phosphinic acid, bis(1-aziridiny)-, ethyl ester, 2	H ₂ O	Dip F	(2)	...	92					
50781	Urea, 1-[bis(1-aziridiny)-phosphinyl]- 3-(3,4-dichlorophenyl)-:	H ₂ O	Dip M	25	15	0					
	5	H ₂ O	Dip F	30	5	0					
	5	H ₂ O	Dip M	0	0	48					
	10	H ₂ O	Dip F	0	0	76					
	10	H ₂ O	Dip F								
50882	Phosphoric triamide, hexamethyl- (hempa):										
	0.15 . . . . .	.....	Fed M	0	0	25					
	.2 . . . . .	.....	Fed M	4	0	5					
50918	Phosphorothioic triamide, hexamethyl, 2	H ₂ O	Dip F	(2)	...	80					
51162	Phosphoric triamide, 2	H ₂ O	Dip M	99	31	2					
51256	Phosphinic amide, <i>P,P</i> -bis(1-aziridiny)- <i>N</i> -isopropyl-:	H ₂ O	Dip M	0	0	84					
	2	H ₂ O	Dip F	(2)	...	72					
51904	1,3-Propanediol, dimethanesulfonate:										
	0.2 . . . . .	.....	Fed M	96	27	0					
	.25 . . . . .	.....	Fed M	0	0	80					
	.25 . . . . .	.....	Fed F	(2)	...	84					
	1 . . . . .	.....	Fed M	(2)	...	84					
	1 . . . . .	.....	Fed F	(2)	...	84					
51959	Ethylenediamine, 1,2-diphenyl-, sulfate (1:1), 0.5	MeOH	Dip M	98	27	45					

		Fed	F	(2)
52100	Benzimidazole, 2-chloro-5-nitro, 1	...	...	64
52484	Ammonium, ethyl[4-[<i>p</i> -[ethyl(<i>m</i> -sulfonylbenzyl)-amino]- α -(<i>o</i> -sulfonylphenyl)benzylidene]-2,5-cyclohexadien-1-ylidene] (<i>m</i> -sulfonylbenzyl)-hydroxide, inner salt, diammonium salt, 1	H ₂ O	Dip M	96
52492	Aniline, 4,4'-thiodi-, 2	MeOH	Dip F	88
52502	Coumarin, 7-(dimethylamino)-4-methyl-, 1	H ₂ O	Dip F	93
52505	<i>o</i> -Toluidine, 4-(<i>o</i> -tolylazo)-, 2	MeOH	Dip M	100
61034	Cadmium, bis(2,4-pentanedionato)-:	H ₂ O	Dip M	40
	2	H ₂ O	Dip M .....	...
	2	H ₂ O	Dip F .....	...
61566	Phosphonothioic diamide, <i>P</i> -(1-azetidinyl)- <i>N,N,N',N'</i> -tetramethyl-, 2	MeOH	Dip M	67
61581	Phosphinothioic amide, <i>P,P</i> -bis(1-aziridinyl)- <i>N</i> -ethyl-:	MeOH	Dip M	0
	2	MeOH	Dip M .....	...
	2	MeOH	Dip F .....	...
61585	Phosphinothioic amide, <i>P,P</i> -bis(1-aziridinyl)- <i>N</i> -methyl-:	H ₂ O	Dip M	0
	2	H ₂ O	Dip M .....	...
	2	H ₂ O	Dip F .....	...
61587	Phosphine sulfide, bis(1-aziridinyl)ethyl-:	MeOH	Dip M	0
	2	MeOH	Dip F .....	...
	2	MeOH	Fed M	0
	.01	...	Fed F .....	...
	.01	...	Fed M	0
	.1	...	Fed F .....	...
	.1	...	Fed M	0
	.5	...	Fed F .....	...
	.5	...	Fed M	0
	.5	...	Fed F .....	...
61934	Acetohydroxamic acid, <i>N</i> -methyl-:	Fed M	77	16
	0.5	Fed F	100	14
	.5	Fed M	22	14
	1	...	...	30
61977	Acrylamide, <i>N,N'</i> -propylidenebis-:	Fed M .....	...	72
	0.5	Fed F .....	...	64
	.5	Fed M .....	...	76
	1	...	...	60
	1	...	...	...

See footnotes at end of table.

TABLE 1.—*Relative effectiveness of candidate chemosterilants on boll weevil hatch, adult emergence, and mortality in dipping and feeding tests. (1 replication of 25 pairs of weevils per test)*—Continued

Entomology No. (ENT-)	Chemical and concentration (percent)	Solvent	EMERGENCE REDUCED TO 33-66 PERCENT		Percent Average hatch sex treated	Percent Average adult emergence	Mortality after 14 days
			Test and Dip	M			
Percent							
5535	<i>m</i> -Dioxane, 5-methyl-4-[3,4-(methylenedioxy) phenyl], 0.01	.....	Fed	M.....	78	60	0
12209	Ammonium, hexadecyltrimethyl- <i>n</i> -bromide, 2	H ₂ O	Dip	F.....	100	59	0
14931	<i>p</i> -Benzosuifone, 2-methyl, 1	.....	Fed	F.....	96	34	0
16630	Hydroquinone, 2,5-di- <i>tert</i> -butyl, 2	.....	Fed	F.....	98	50	0
24916	Phosphine sulfide, tris(1-aziridinyl), 2	MeOH	Dip	F.....	86	54	20
25012	1,4-Butanediol, dimethanesulfonate, 2	DMSO	Dip	M.....	100	60	40
26304	1-Propanol, 2,3-dibromo-:	.....	Fed	M.....	44	40	36
	1	.....	Fed	F.....	50	66	12
26388	Hydantoin, 1-[4-nitrofurfurylidene) amino]-1	.....	Fed	M.....	87	53	2
27439	4-Imidazolin-2-one, 2	.....	Dip	M.....	100	63	0
34148	3,7-Tridecadien-2-one, 11,12-epoxy-4,8,12- trimethyl-(mixed isomers), 0.0005	.....	Fed	M.....	100	61	0
50233	Purine, 6-[(<i>o</i> -chlorobenzyl)thio]-, 0.5	MeOH	Dip	M.....	81	53	0
50466	Acetotohydroxamic acid, <i>N</i> -fluoren-2-yl, 0.5	MeOH	Dip	F.....	98	55	28
50761	Phosphinic acid, bis(1-aziridinyl)-, ethyl ester, 2	.....	Dip	M.....	32	48	84
50882	Phosphoric triamide, hexamethyl-(hempa):	.....	Dip	M.....	82	54	1
	2	H ₂ O	Dip	F.....	100	59	0
	2	.....	Fed	M.....	48	48	0
	.1	.....	Fed	F.....	69	39	15
	.15	.....	.....	.....	80	60	1
	.2	.....	.....	.....	80	60	1

50987	1-Aziridinecarboxamide, <i>N,N'</i> -vinylenebis-, (E)-:	2..... 2..... 2.....	MeOH..... H ₂ O..... H ₂ O.....	Dip M..... Dip M..... Dip M.....	46..... 36..... 36.....	39..... 36..... 36.....	58..... 0..... 0.....
50991	Phosphonic diamide, <i>P</i> -(1-aziridinyl)- <i>N,N,N',N'</i> -tetramethyl-, 2 .....	..... ..... .....	H ₂ O	Dip M	58	64	38
51272	Guanazole:	2..... 2..... 1.....	MeOH	Dip M	100	61	4
51862	Boric acid, triphenyl ester:	2..... 1.....	MeOH	Dip M	100	60	0
51904	1,3-Propanediol, dimethanesulfonate:	0.05..... 0.15.....	..... .....	Fed M	78	48	2
51959	Ethylenediamine, 1,2-diphenyl-, sulfate (1:1), 1 .....	..... .....	..... .....	Fed M	64	45	0
51986	Semicarbazide, 1-benzoyl-3-thio-, 1 .....	.....	MeOH	Dip M	100	62	0
52055	Imidazole, 5-(benzylthio)-1-methyl-4-nitro-, 0.5 ..	.....	MeOH	Dip M	100	60	0
52068	Purine, 6-(phenylthio)-, 0.5 .....	.....	.....	Fed F	96	40	1
52102	Phenol, <i>m</i> -(salicylideneamino)-, 2 .....	.....	DMSO	Dip M	75	62	32
52129	2-Norbornanamine, monohydrochloride:	2..... 2.....	H ₂ O	Dip M	76	56	5
52484	Ammonium, ethyl[4-[<i>p</i> -[ethyl(<i>m</i> -sulfonyl)-amino]- <i>α</i> -(sulfonylphenyl)-benzylidene]-2,5-cyclohexadien-1-ylidene] (<i>m</i> -sulfonylphenyl)hydroxide, inner salt, diammonium salt:	..... 1..... 1.....	..... ..... .....	Fed M	95	66	8
52492	Aniline, 4,4'-thiodi-:	2..... .1..... .1.....	MeOH	Dip M	100	60	25
52495	Aniline, 4,4'-methylenedi-, dihydrochloride:	2..... 2.....	H ₂ O	Dip M	100	58	0
			H ₂ O	Dip F	100	53	0

See footnotes at end of table.

TABLE 1.—*Relative effectiveness of candidate chemosterilants on boll weevil hatch, adult emergence, and mortality in dipping and feeding tests. (1 replication of 25 pairs of weevils per test)—Continued*

Entomology No. (ENT-)	Chemical and concentration (percent)	Solvent	Test and sex treated	Average hatch	Average adult emergence	Mortality after 14 days
				Percent	Percent	Percent
52497	1-Anthramine, 1 .....	.....	Fed F	100	48	5
52505	<i>o</i> -Toluidine, 4-(<i>o</i> -tolylazo):					
	1	MeOH	Dip M	53	35	0
	1 .....	.....	Fed F	96	41	17
60131	Melamine, <i>N</i> ² , <i>N</i> ⁴ , <i>N</i> ⁶ -trichloro-, 0.5 .....	.....	Fed F	100	57	0
60242	Phenazine, 3-amino-6-(dimethylamino)-2-methyl-, monohydrochloride:					
	2	H ₂ O	Dip F	90	93	2
	.5 .....	.....	Fed M	100	59	38
61285	1-Adamantanol, 2	MeOH	Dip F	100	40	22
61530	Ammonium, trimethyl purin-6-yl hydroxide, inner salt:					
	2	H ₂ O	Dip M	98	40	10
	2	H ₂ O	Dip F	100	60	2
61566	Phosphonothio diamide, <i>P</i> -(1-azetidinyl)- <i>N,N,N',N'</i> -tetramethyl-, 2	MeOH	Dip F	71	63	0
61587	Phosphine sulfide, bis(1-aziridinyl)ethyl-, 2	MeOH	Dip M	72	40	45
61934	Acetohydroxamic acid, <i>N</i> -methyl-, 1 .....	.....	Fed F	50	50	38
61946	Isoquinaldic acid, 2	H ₂ O	Dip M	100	59	0
70348	2-Dodecenoid acid, 7,11-dichloro-3,7,11-trimethyl-, ethyl ester, (E), 0.5 .....	.....	Fed M	44	61	0
70351	2-Octene, 6,7-epoxy-3,7-dimethyl-1-(2-propynylxylo)-, 0.5 .....	.....	Fed M	92	40	0
	EMERGENCE REDUCED TO 66-100 PERCENT					
329	Phthalic acid, diethyl ester:					
	2	MeOH	Dip M	100	100	0
	2	MeOH	Dip F	100	86	0
	1 .....	.....	Fed M	96	100	0
	1 .....	.....	Fed F	92	91	0

754	Benzophenone:	2.....	MeOH.....	Dip M.....	64	95
		2.....	MeOH.....	Dip F.....	100	100
		1.....	Dip.....	Fed M.....	96	2
		1.....	.....	Fed F.....	81	0
		1.....	.....	.....	100	30
2546	Furil:	2.....	MeOH.....	Dip M.....	100	0
		2.....	.....	Dip F.....	91	8
		1.....	.....	Fed F.....	100	12
3117	Phenethylamine:	2.....	MeOH.....	Dip M.....	100	2
		2.....	MeOH.....	Dip F.....	86	0
		1.....	.....	Fed M.....	88	2
		1.....	.....	Fed F.....	100	14
3357	1-Butanol, 2-amino-:	2.....	H ₂ O.....	Dip M.....	100	0
		2.....	H ₂ O.....	Dip F.....	100	0
		.5.....	.....	Fed M.....	85	6
		.5.....	.....	Fed F.....	98	2
5535	<i>m</i> -Dioxane, 5-methyl-4-[3,4-(methyleneoxy)phenyl]-:	2.....	MeOH.....	Dip M.....	78	26
		2.....	MeOH.....	Dip F.....	100	30
		.01.....	.....	Fed F.....	60	0
12133	Acetophenone, 4'-hydroxy-:	2.....	MeOH.....	Dip M.....	100	0
		2.....	MeOH.....	Dip F.....	90	0
		1.....	.....	Fed M.....	100	0
		1.....	.....	Fed F.....	69	30
12209	Ammonium, hexadecyltrimethyl _____ bromide:	2.....	H ₂ O.....	Dip M.....	93	0
		.125.....	.....	Dip F.....	84	8
		.125.....	.....	Fed F.....	83	0
14653	2-Propanol, 1-amino-:	2.....	H ₂ O.....	Dip M.....	84	22
		2.....	H ₂ O.....	Dip F.....	80	2
		.1.....	.....	Fed M.....	96	0
		.1.....	.....	Fed F.....	95	0

See footnotes at end of table.

TABLE 1.—*Relative effectiveness of candidate chemosterilants on boll weevil hatch, adult emergence, and mortality in dipping and feeding tests. (1 replication of 25 pairs of weevils per test)—Continued*

Entomology No. (ENT-)	Chemical and concentration (percent)	Solvent	Test and sex treated	Average hatch	Average adult emergence	Mortality after 14 days
				Percent	Percent	Percent
14879	Carbanilic acid, isopropyl ester:					
0.5.....	.....	.....	Fed M	100	84	4
.5.....	.....	.....	Fed F	100	81	8
1.....	.....	.....	Fed M	100	100	0
1.....	.....	.....	Fed F	100	81	28
2.....	.....	.....	Fed M	86	81	0
2.....	.....	.....	Fed F	95	67	2
14931	<i>p</i> -Benzoquinone, 2-methyl-:					
1.....	.....	.....	Fed M	95	82	4
2.....	.....	.....	Fed M	99	76	42
2.....	.....	.....	Fed F	100	88	0
15229	Anthranilic acid, 5-chloro-:					
2.....	.....	.....	Dip M	92	96	4
1.....	.....	.....	Fed M	100	100	0
1.....	.....	.....	Fed F	100	73	0
15365	Hydrazobenzene:					
2.....	.....	.....	Dip M	100	100	0
2.....	.....	.....	Dip F	100	95	0
1.....	.....	.....	Fed M	100	100	32
1.....	.....	.....	Fed F	100	100	0
16630	Hydroquinone, 2,5-di- <i>tert</i> -butyl-:					
2.....	.....	.....	Dip M	90	91	6
1.....	.....	.....	Fed M	100	100	0
1.....	.....	.....	Fed F	100	100	12
19187	Tartar emetic:					
0.1.....	.....	.....	Dip M	95	100	10
.1.....	.....	.....	Dip F	100	100	14
22596	2-Pyridinethiol, 1-oxide, sodium salt:					
0.5.....	.....	.....	Fed M	99	100	44
.5.....	.....	.....	Fed F	66	88	48
1.....	.....	.....	Dip M	100	90	0
1.5.....	.....	.....	Dip F	75	90	0

23427	Pseudourrea, 2-(2-aminoethyl)-2-thio-dihydrobromide:	1	H ₂ O	Dip M	100	100	10
		1	H ₂ O	Dip F	100	100	15
		2	H ₂ O	Dip M	100	100	20
		2	H ₂ O	Dip F	100	100	20
		4	H ₂ O	Dip M	100	100	5
		4	H ₂ O	Dip F	100	100	0
		.5	.....	Fed M	79	100	8
		.5	.....	Fed F	97	100	0
		1	.....	Fed M	87	73	0
		1	.....	Fed F	46	100	0
24112	2-Picoline, 6-amino-:	2	H ₂ O	Dip M	100	100	0
		2	H ₂ O	Dip F	100	100	0
		1	.....	Fed M	94	100	0
		1	.....	Fed F	96	100	0
24809	1,4-Diazabicyclo[2.2.2]octane:	2	H ₂ O	Dip M	100	100	0
		2	H ₂ O	Dip F	84	100	0
		1	.....	Fed M	90	100	0
		1	.....	Fed F	92	100	22
24916	Phosphine sulfide, tris(1-aziridinyl)-:	0.1	H ₂ O	Dip M	100	100	0
		.1	H ₂ O	Dip F	100	100	0
		.2	H ₂ O	Dip M	100	100	0
		.2	H ₂ O	Dip F	100	100	0
		2	MeOH	Dip M	94	79	20
26388	Hydantoin, 1-[(5-nitrofurfurylidene)amino]-:	0.5	MeOH	Dip M	98	100	45
		.5	MeOH	Dip F	77	100	25
		1	.....	Dip M	85	100	35
		1	.....	Dip F	79	100	60
		2	.....	Dip M	100	100	15
		2	.....	Dip F	79	100	50
		1	.....	Fed F	93	100	10

See footnotes at end of table.

TABLE 1.—*Relative effectiveness of candidate chemosterilants on boll weevil hatch, adult emergence, and mortality in dipping and feeding tests. (1 replication of 25 pairs of weevils per test)—Continued*

Entomology No. (ENT-)	Chemical and concentration (percent)	Solvent	Test and sex treated	Average hatch	Percent		Mortality after 14 days
					Percent	Percent	
26685	Triethylamine, 2'-chloro-1,1'-dimethyl, monohydrochloride:	H ₂ O	Dip M	100	100	0	
		H ₂ O	Dip F	91	77	0	
		H ₂ O	Dip M	100	100	5	
		H ₂ O	Dip F	84	100	5	
		H ₂ O	Dip M	99	79	0	
		H ₂ O	Dip F	100	89	0	
		H ₂ O	Fed M	66	92	50	
		
		
		
27439	4-Imidazolin-2-one:	H ₂ O	Dip M	100	79	0	
		H ₂ O	Dip F	100	92	0	
		H ₂ O	Dip F	100	84	0	
		
30023	Benzophenone, phenylhydrazone:	MeOH	Dip M	100	85	2	
		MeOH	Dip F	100	68	2	
		...	Fed M	100	94	16	
		...	Fed F	100	94	0	
		
31295	1,3-Butanedione, 4,4,4-trifluoro-1-(2-thienyl)-:	MeOH	Dip M	87	93	32	
		MeOH	Dip F	100	71	0	
		...	Fed M	96	100	42	
		...	Fed F	90	100	18	
		
34148	3,7-Tridecadien-2-one, 11,12-epoxy-4,8,12-trimethyl- (mixed isomers):	...	...	...	...	...
		0.0005	Fed F	96	100	0	
		.001	Fed M	96	83	0	
		.001	Fed F	100	100	0	
34254	3,7-Tetradecadien-2-one, 11,12-epoxy-8-ethyl-4,12-dimethyl- (mixed isomers):	...	...	...	...	...
		0.35	Fed F	100	71	10	
		.7	Fed M	100	95	26	

See footnotes at end of table.

TABLE 1.—*Relative effectiveness of candidate chemosterilants on boll weevil hatch, adult emergence, and mortality in dipping and feeding tests. (1 replication of 25 pairs of weevils per test)*—Continued

Entomology No. (ENT-)	Chemical and concentration (percent)	Solvent	Test and sex treated	Average hatch	Average adult emergence	Mortality after 14 days
				Percent	Percent	Percent
51862	Boric acid, tripentyl ester: 2 1	MeOH	Dip F Fed M	100 74	95 100	0 4
51959	Ethylenediamine, 1,2-diphenyl, sulfate (1:1), 2	MeOH	Dip M	100	97	10
51964	2-Pyridinecarbamic acid, ethyl ester: 0.5 .5 1 1 1 1 1	MeOH MeOH MeOH MeOH	Dip M Dip F Dip M Dip F Fed M Fed F	91 88 92 100 100 100	80 72 83 100 100 93	0 14 10 14 0 0
51968	<i>m</i> -Benzene dicarbamic acid, diethyl ester: 1 1 2 2 4 4 .1 .1 .1 .25 .25 .5 .5 1 1	MeOH MeOH	Dip M Dip F Dip M Dip F Dip F Fed M Fed F Fed M Fed M Fed F Fed F Fed M Fed F	84 57 87 85 80 48 96 96 100 100 96 100 100 100	93 100 78 78 78 85 100 100 100 100 100 100 100 100	0 45 35 0 5 5 12 8 4 0 0 8 0 4 16
51986	Semicarbazide, 1-benzoyl-3-thio-:	MeOH MeOH MeOH MeOH	Dip F Dip M Dip M Dip F Fed M Fed F Fed M Fed F	100 100 61 100 88 76	93 100 100 92 100 100	35 5 0 20 12 0

51996	Guanidine, [<i>p</i> -hydroxybenzylidene] amino]-:	0.1 .1 .25 .25 1 1	0 Fed Fed Fed Fed Fed Fed	M F M F M F M	0 100 100 100 100 100 100	0 12 16 0 8 4
52055	Imidazole,5-(benzylthio)-1-methyl-4-nitro-:	0.5 1 2 .125 .125 .25 .25 .5 .5 .75 .75	0.5 MeOH MeOH MeOH Fed Fed Fed Fed Fed Fed Fed Fed	Dip F M F M F M F M	98 93 84 96 92 82 100 100 100 100 100 100	0 0 0 24 0 0 0 0 0 0 0
52068	Purine, 6-(phenylthio)-:	0.5 1 1	0.5 Fed Fed Fed	M F M F M	86 90 100	1 100 100
52100	Benzimidazole, 2-chloro-5-nitro-:	0.5 .5 1 1 2 2 1	0.5 MeOH MeOH MeOH MeOH MeOH MeOH Fed	Dip F M F M F M	100 100 100 100 100 100 100	5 0 10 0 0 0 68
52102	Phenol, <i>m</i> -(salicylideneamino)-:	1 2 1	1 MeOH MeOH Fed	M F M	66 73 100	5 0 0

TABLE 1.—*Relative effectiveness of candidate chemosterilants on boll weevil hatch, adult emergence, and mortality in dipping and feeding tests. (1 replication of 25 pairs of weevils per test)—Continued*

Entomology No. (ENT-)	Chemical and concentration (percent)	Solvent	Test and sex treated	Percent		Percent	Percent
				Average hatch	Average adult emergence		
52108	Purine, 2-(butylamino)-6-(methylamino)-:						
	0.5	MeOH	Dip M	98	100	0	0
	.5	MeOH	Dip F	93	100	0	0
	1	MeOH	Dip M	87	93	0	0
	1	MeOH	Dip F	98	100	15	15
	2	MeOH	Dip M	84	100	15	15
	2	MeOH	Dip F	82	80	0	0
	.1	MeOH	Fed M	98	100	0	0
	.1	MeOH	Fed F	98	100	6	6
	.25	MeOH	Fed M	100	100	2	2
	.25	MeOH	Fed F	100	93	2	2
	.5	MeOH	Fed M	96	100	6	6
	.5	MeOH	Fed F	100	100	2	2
	1	MeOH	Fed M	98	100	0	0
	1	MeOH	Fed F	100	100	0	0
52129	2-Norbornamine, monohydrochloride:						
	1	H ₂ O	Dip M	100	100	0	0
	1	H ₂ O	Dip F	100	95	0	0
	.05	.....	Fed M	100	88	0	0
	.05	.....	Fed F	100	100	0	0
	.1	.....	Fed M	100	100	0	0
	.1	.....	Fed F	100	100	0	0
52138	Guanidine, amino-, compound with carbonic acid (1:1):						
	2	MeOH	Dip M	100	76	0	0
	2	MeOH	Dip F	97	88	14	14
	1	.....	Fed M	100	100	0	0
	1	.....	Fed F	74	89	4	4
52396	Methane, triiodo-:						
	0.5	DMSO	Dip M	100	100	0	0
	.5	DMSO	Dip F	100	100	0	0
	1	DMSO	Dip M	100	100	0	0
	1	DMSO	Dip F	100	100	0	0
	2	DMSO	Dip M	100	85	0	0
	2	DMSO	Dip F	100	100	0	0

See footnotes at end of table.

TABLE 1.—*Relative effectiveness of candidate chemosterilants on boll weevil hatch, adult emergence, and mortality in dipping and feeding tests. (1 replication of 25 pairs of weevils per test)*—Continued

61433	Ammonium, hexamethylenebis[trimethylchloride]:	2	0	0
		2	2	2
		25	10	10
		.25	12	12
61453	s-Triazin-2-ol, 4,6-bis(dimethylamino), compound with mercuric chloride (1:1):	2	0	0
		2	0	0
		.001	4	4
		.001	0	0
		.01	0	0
		.01	0	0
		.1	16	16
		.1	0	0
		.5	44	44
		.5	24	24
		.5	40	40
61527	Ammonium, 2-butynylenebis[trimethylchloride]:	2	0	0
		2	0	0
61567	Phosphoric triamide, <i>N,N</i> '''-methylenebis[pentamethyl]-:	0.5	6	6
		.5	0	0
61580	Phosphinothioic amide, <i>P,P</i> -bis(1-aziridiny)-N-propyl-:	0.125	8	8
		.125	28	28
		.25	16	16
		.25	28	28
61946	Isoquinaldlic acid:	2	28	28
		.1	34	34
		.1	0	0
		.2	10	10
		.2	0	0

TABLE 1.—*Relative effectiveness of candidate chemosterilants on boll weevil hatch, adult emergence, and mortality in dipping and feeding tests. (1 replication of 25 pairs of weevils per test) —Continued*

Entomology No. (ENT-)	Chemical and concentration (percent)	Solvent	Test and sex treated		Percent	Percent	Percent	Percent
			Average hatch	Average adult emergence				
61948	1,3,4-Thiadiazole, 2,2'-dithiobis[5-amino]-:							
	2	MeOH	Dip M		98	86	32	
	2	MeOH	Dip F		100	100	8	
	1	.....	Fed M		100	100	0	
	1	.....	Fed F		100	100	10	
	2	.....	Fed M		93	100	0	
	2	.....	Fed F		93	100	10	
70159	Ethane, 1-[(6,7-epoxy-3,7-dimethyl-2-octenyl)- oxy]-2-ethoxy, (E)-:							
	0.5	H ₂ O	Dip M		100	100	17	
	.5	H ₂ O	Dip F		100	100	7	
	1	H ₂ O	Dip M		100	100	7	
	1	H ₂ O	Dip F		100	100	32	
	.5	.....	Fed M		100	100	4	
	.5	.....	Fed F		100	100	12	
	1	.....	Fed M		100	100	4	
	1	.....	Fed F		100	100	0	
70348	2-Dodecanoic acid, 7,11-dichloro-3,7,11-trimethyl-, ethyl ester, (E)-:							
	1	MeOH	Dip M		86	90	0	
	1	MeOH	Dip F		100	70	0	
	2	MeOH	Dip M		91	86	0	
	2	MeOH	Dip F		100	84	5	
	.5	.....	Fed F		100	96	0	
	1	.....	Fed M		86	96	0	
	1	.....	Fed F		100	100	0	

70349	Benzoic acid, <i>p</i> -(1,5-dimethylhexyl)oxy]-, methyl ester:	1	MeOH	Dip M	79	99	0
		1	MeOH	Dip F	97	70	0
		2	MeOH	Dip M	84	100	0
		2	MeOH	Dip F	97	100	0
		.5	.....	Fed M	87	68	0
		.5	.....	Fed F	96	88	0
		1	.....	Fed M	100	100	0
		1	.....	Fed F	81	82	0
70350	2,6-Dodecadienoic acid, 11,11-epoxy-3,7,10,11-tetramethyl-, ethyl ester:	1	MeOH	Dip M	100	96	0
		1	MeOH	Dip F	91	84	0
		2	MeOH	Dip M	100	70	0
		2	MeOH	Dip F	98	90	0
		.5	.....	Fed M	100	84	0
		.5	.....	Fed F	100	100	0
		1	.....	Fed M	89	82	0
		1	.....	Fed F	100	92	0
70351	2-Octene, 6,7-epoxy-3,7-dimethyl-1-(2-propynylxy) -:	1	MeOH	Dip M	100	72	0
		1	MeOH	Dip F	92	100	0
		2	MeOH	Dip M	97	76	0
		2	MeOH	Dip F	84	78	0
		.5	.....	Fed M	100	100	0
		.5	.....	Fed F	100	100	0

1 Treated male X untreated female in dinning tests

- Treated male
? No eggs laid

2 No eggs laid.
3 Treated female X untreated male in feeding tests

